

THE COST PRICE OF GROWING LAVENDER (*LAVANDULA OFFICINALIS*) AND THE ECONOMIC EFFICIENCY OF ITS PROCESSING IN THE TERRITORY OF THE FEDERATION OF BOSNIA AND HERZEGOVINA*

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Original scientific paper

Abstract

Lavender is one of the Lamiaceae family's most famous ornamental, aromatic, and medicinal plants. It is widely used in the cosmetic, pharmaceutical and food industries and is an excellent honey plant. The plantation cultivation of lavender in BiH is still not as developed as in other countries. Still, an increasing number of farms and specialized farms recognize this culture's potential. Given the need for more research on the economic results of growing lavender in Bosnia and Herzegovina, this research aims to analyze the cost of growing fresh lavender and the economic efficiency of its processing. Primary data was collected with the help of surveys conducted on four farms, focusing on the necessary investments and operational costs of growing lavender and the income from the sale of dried flowers. The results showed that the cost of growing 1 kg of fresh lavender flowers ranges from 0.71 BAM to 1.33 BAM, which indicates significant differences between the observed farms. Lavender processing also showed different levels of economy among farms. According to this research, cultivating lavender in Bosnia and Herzegovina is an economically profitable option; however, it is necessary to research a more significant number of farms. Also, due to different applied agricultural techniques in the cultivation of lavender, economic results differ significantly from farm to farm, so one of the research recommendations is additional education of producers in this area to increase the economic efficiency of these farms with the improvement of production technology.

Keywords: *economic efficiency, cost price, lavender, Federation of Bosnia and Herzegovina*

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INTRODUCTION

Lavender is an aromatic, ornamental and medicinal plant known for its healing properties and wide application in the cosmetic, pharmaceutical, food and decorative industries (Gadzo, 2017). It grows at an altitude of up to 1,700 m above sea level, and its habitat is bogs, rock gardens and pastures (Jurkic, 2014). This plant is characterized by exceptional resistance, capable of withstanding temperatures as low as -20°C (Mihovilovic, 2005). For successful production, knowing and applying correct agrotechnical methods is essential. As a perennial plant, it can last 15 to 20 years with proper care, ensuring a high yield and quality flowering (Grbesa, 2016). It requires sunny and warm conditions for optimal growth (Mihovilovic, 2005). It is traditionally grown in areas with a Mediterranean climate, but due to its resistance to low temperatures, it is also grown in continental and temperate-continental climates. There are more than 40 species of this plant; the most widely cultivated are *Lavandula officinalis*, *Lavandula dentata*, *Lavandula stoechas* and *Lavandula x intermedi* (Parida, 2022). A strong, distinctive smell from the accumulated essential oil characterizes all types of lavender.

Lavender is mainly processed in the dryer, where dried lavender is obtained, and through the distillery, where the essential oil is obtained through the distillation process, and the side product hydrolat is created. For 1 kg of dried lavender, 8-10 kg of fresh lavender is used (Siljes *et al.*, 1992.). Various factors will influence the quantity and quality of the final dried product during the drying process. Drying parameters depend on environmental conditions and lavender varieties, which influence the final yield of dried lavender (Sařata, 2020). Different studies have shown that drying methods contribute considerably to moisture diffusion and energy consumption during the drying process. Similar results were found by Masztalerz *et al.* (2021), who conducted a study on combined drying methods, which resulted in a shortening of drying time and improved the quality of dried lavender. It has also been emphasized that drying techniques such as heat pump drying can retain the phytochemical composition of lavender more than traditional hot-air drying methods (Falla *et al.*, 2022)

Essential oil is obtained by distillation of lavender flowers. Natural lavender contains 0.5 to 1.5% essential oil (Bozanov, 2018). Lavender essential oil is mainly used in the cosmetics, fragrance and perfumery industries. Nevertheless, there is an increasing interest in its use in aromatherapy (Singh *et al.*, 2007). The essential oils extracted from dried lavender are highly valued in various industries, including food, cosmetics, and aromatherapy, further emphasizing the importance of effective drying methods to maintain quality (Łyczko *et al.*, 2019).

The world's largest lavender producers include the USA, Australia, South Africa, Algeria and Argentina, while in Europe, countries such as Bulgaria, England, France, Italy, Spain, Hungary, and the former Yugoslavia stand out (Gadzo, 2017). Apart from

direct income for the farms that produce it, lavender can also contribute to the tourism segment of a country's economy, which speaks of its potential for developing agritourism in Bosnia and Herzegovina. Lavender cultivation is environmentally friendly for several reasons: no pesticides are used, and small amounts of water and mineral fertilizers are used, which do not create large amounts of waste (Zutic, 2014). Growing lavender is increasingly popular in Bosnia and Herzegovina thanks to favourable climatic conditions, and specialized farms recognize its potential. Although lavender production in Bosnia and Herzegovina is still in its early stages, the global demand for natural and aromatic herbs is growing, which opens opportunities for further development of this crop. Studies on lavender production or its economic impact in Bosnia and Herzegovina are minimal, so this research aims to analyse the cost of growing fresh lavender and the economic efficiency of its processing.

MATERIALS AND METHODS

The primary source of data is surveys conducted to collect information on the costs, yields, and incomes of four farms that grow lavender (Sarajevo, Visoko, Mostar and Stolac). Farm sizes and farm locations are Farm 1 (F1) with an area of 3.0 dunums in Visoko, Farm 2 (F2) with an area of 1.2 dunums in Mostar, Farm 3 (F3) with an area of 35.0 dunums in Stolac and Farm 4 (F4) with an area of 2.5 dunums in Sarajevo. Data was collected through personal interviews with farmers, during which information was collected on the costs of inputs such as seedlings, fertilizers, pesticides, labour, and others. Furthermore, data were collected on lavender yields, sales prices, and challenges and problems in production. After collecting and entering the data into Excel 365, a detailed economic analysis was performed to obtain basic information about these units' financial success. The study included assessing the necessary investments per dunum of lavender, the achieved average yields, and costs, which enabled the calculation of the cost price of fresh lavender. Special attention is paid to calculating the costs of drying lavender, including the costs of equipment for a dryer with a capacity of 300 kg, energy, and labour costs. A partial market analysis was carried out, which included the main sales channels of these products and their prices on the market. With this information, it was possible to obtain the cost price for growing lavender, as well as the expected profit for its drying.

The cost price for fresh Lavender is calculated according to the formula (Mulic, 1983):

$$\text{Cost price} = \text{Total cost}/\text{Yields}$$

Profit for drying lavender was calculated according to standard formula:

$$\text{Profit} = \text{Revenues} - \text{Total cost}$$

Economic efficiency for draying lavender is calculated based on next formula (Falan and Mujcinovic, 2022):

$$\text{Economic Efficiency} = \text{Revenues} / \text{Total costs}$$

RESULTS AND DISCUSSION

The presented data sequentially provides an overview of the average costs of cultivating lavender on an area of 1,000 m² across the analyzed farms. Further analyses summarize the costs and cost of lavender cultivation for the individual farm's total area. The last group of information offers a financial analysis of the costs involved in drying lavender using dryers with a 300 kg capacity.

Table 1. The average costs of cultivation lavender on the area of 1,000 m² of analyzed farms

				(in BAM)
Description	Unit	Amount	Price	Total
Yields				
Lavender (flower)	kg	1,218	-	-
Fertilizer	kg	25	1.12	28
Pesticide	kg	0	-	0
Labour	day	10	65	650
Mechanization	day	3	100	300
Packaging				56
Depreciation				183
Other costs				90
TOTAL COST				1,307
Cost price				1.07

Table 1 comprehensively summarizes the average costs of cultivating lavender on 1,000 m² at observing farms. Here, we can see a detailed average calculation, specifically for the four observed cases, where the consumption of individual material inputs is presented along with their costs. The total costs of fertilizers, pesticides, labour, mechanization, packaging, and depreciation amounted to 1,307 BAM per 1,000 m². In the cost structure, the most significant are those associated with wages due to using manual labour, which accounts for nearly 50% (650 BAM) of the total annual costs. Mechanization also incurs significant expenses, making up slightly less than 25% (300 BAM) of the total expenses for maintaining lavender plantations. It is also important to emphasize the depreciation costs, which amount to 183 BAM. These are exclusively related to the depreciation of the lavender plantation and were calculated based on preliminary analyses, which considered the total costs for establishing such a plantation.

With average yields of 1.218 kg per dunum and the costs shown, 1 kg of fresh lavender cost was 1.07 BAM.

Similarly, detailed calculations were made for each farm, as shown in Table 2.

Table 2. Costs and cost of lavender cultivation on the total area for the analyzed farms
(in BAM)

Description	F1*	F2*	F3*	F4*
Total Yields (kg)	3,000	2,500	43,750	1,560
Area of farm (1000m ²)	3	1	35	2.5
Yields per 1 dunum (kg)	1,000	2,084	1,250	624
Fertilizers	1,197	0	0	0
Pesticide	0	0	0	0
Labour	1,200	1,120	31,500	750
Mechanization	600	400	10,500	500
Packaging	167	0	2,188	0
Depreciation	600	168	6,195	530
Other costs	240	150	1,000	200
TOTAL COST	4,004	1,838	51,383	1,980
Cost per dunum	1,335	1,838	1,468	566
Cost price	1,33	0,74	1,17	1,27

*F1, F2, F3 and F4 are the labels for the four observed farms (Farm 1, Farm 2, Farm 3, Farm 4)

Table 2 shows that farm size significantly affects total costs, labour and mechanization use. Farm F3 has the highest yield at 43,750 kg, while F4 has the lowest yield at 1,560 kg. Yields per 1 dunum show a significant variation, with F2 achieving the highest yield of 2,084 kg, while F4 produces only 624 kg. Total costs are highest for the F3 farm, which is 51,383 BAM, corresponding to its larger area and higher yields. Farm F2 has the lowest total cost with an amount of 1,838 BAM, reflecting its small size and lack of additional inputs like fertilizer and packaging. The cost per kilogram is lowest for F2 (0,74 BAM), indicating more cost-efficient production, while F1 and F4 have relatively higher cost prices (1,33 BAM and 1,27 BAM). Farm F3 has a moderate cost of 1,17 BAM.

Such significant differences in the cost price of fresh lavender flowers are primarily due to the different technologies applied in lavender cultivation and different production intensities. These differences are most evident in the planting density of individual lavender plantations but also in the agro-techniques used throughout the year, including

the application of organic fertilizers and other technical practices such as timely soil treatment and fertilization.

Table 2 shows the differences in cultivation and maintenance technologies for lavender plantations when observing the various costs per dunum across the studied farms.

What is particularly interesting is that the farm with the highest costs per dunum in production achieves the lowest cost price for cultivated lavender. Although the highest costs per dunum amounted to 1,838 BAM, the yield was 2,084 kg of fresh lavender flowers, resulting in a cost price of only 0.74 BAM per kg. The farm with the lowest costs per dunum, amounting to 566 BAM, achieves a high-cost price (1.27 BAM/kg) for lavender produced.

This shows how the application of higher intensive agrotechnical measures, even with a higher cost per unit of production (1.000 m²), benefits in achieving better economic results.

Table 3. Financial analysis of drying Lavender in dryers with 300 kg capacity

Description	(in BAM)			
	F1	F2	F3	F4
Dry lavender (kg)	334	278	5250	173
Price	13	13	13	13
Total Revenues	4,336	3,614	68,250	2,253
Lavender	4,004	1,838	51,383	1,980
Energy costs	280	252	4,424	146
Labor costs	200	280	3,150	450
Maintenance costs	120	120	120	120
Packaging	17	14	263	9
Depreciation	460	460	460	460
Other costs	180	110	950	160
TOTAL COSTS	5,261	3,074	60,750	3,325
PROFIT	-925	540	7,500	-1,072
Cost price	15.75	11.06	11.57	19.22
Economic Efficiency	0.82	1.18	1.12	0.68

Table 3 provides a financial breakdown of the revenue, costs, and profit from drying lavender across four farms: F1, F2, F2, and F4. It includes total revenues, costs, and profits, offering a comparison of each farm's financial efficiency. Those are hypothetical results that are not found on all observed farms. We wanted to check how investments in a dryer with 300 kg capacity could impact the economic results of those farms. Findings can be seen in Table 3.

Farm F3 produces the highest amount of dried lavender, 5,250 kg, while F4 produces the lowest, 173 kg. The price of dried lavender per kilogram is the same for each farm, which was the case on the market in this period. Revenues are highest for F3, with 68,250 BAM due to its large production, while F4 generates the lowest income of 2,253

BAM. The costs between farms are different due to various factors, one of the most important of which is the amount of lavender production on the farm. Most of the costs go to lavender production, and other costs are included, such as energy and labour costs, maintenance costs, packaging, depreciation and other costs. The total costs are the highest for farm F3, which amounts to 60,750 BAM, followed by F1 with 5,261 BAM, F4 with 3,325 BAM, and F2 with 3,074 BAM. Farms that have positive profits are F2 and F3, but F2 generates a more balanced revenue-to-cost ratio. F1 and F3 both experience losses, with F1 having a negative profit of -925 BAM and F4 losing -1,072 BAM. The price per kilogram of dried lavender varies significantly, with F4 having the highest cost price of 19,22 BAM, making it less efficient than F2, which has the lowest cost price of 11,06 BAM. Farms F1 and F3 have intermediate cost prices. Efficiency is highest for F2 with 1,18, indicating that it generates the most revenue relative to its costs. F3 with efficiency 1,12 is also relatively efficient. Farms F1 and F4 have an efficiency of less than 1, showing that their costs are higher than revenue, so these two farms are not economically efficient in producing dried lavender.

Now, it is possible to see how the lower cost of fresh lavender impacts the financial results of dried lavender. F2, although the smallest in terms of area, achieves by far the lowest cost of lavender cultivation, so the investment in a dryer is worthwhile, regardless of the small volume of production. Also, the largest of the observed F3, shows positive results when investing in a small capacity dryer of 300 kg. For this size of farm, it would be interesting to make a financial analysis of investments in dryers of larger capacity. This would reduce drying time and the use of labour for this process. For F1 and F2, the cost of dried lavender, under this condition, is too high, and the selling price is lower than the costs per kg of dry lavender produced.

CONCLUSION

The economic outcomes of lavender cultivation vary considerably across farms due to differences in agricultural practices, farm sizes and production techniques. This variability highlights the importance of further education and training for producers to enhance the economic efficiency of lavender farming; by improving production technology and applying optimal agrotechnical practices, farmers can significantly increase their profitability. Based on this research, lavender cultivation in Bosnia and Herzegovina can be economically viable, provided that adequate farming techniques are employed. However, for a more comprehensive understanding of the economic potential of this crop, it is essential to gather data from a larger sample of farms. Expanding the scope of the research would allow for more precise conclusions and better-informed recommendations for the industry. Additionally, when considering potential investments in small-capacity dryers on these farms, it becomes evident that, with appropriate and timely agrotechnical practices, positive results can be achieved even on very small farms. Agro techniques need to be well implemented, and yields need to be higher per production unit. Future research should be implemented for larger

farms about investments in higher-capacity dryers, which would increase depreciation costs, but potentially, other running costs could be lower.

REFERENCES

- Bozanov, I. (2018). PESTLE analiza proizvodnje lavande, Doktorska disertacija, Josip Juraj Strossmayer University of Osijek. Faculty of Agrobiotechnical Sciences Osijek.
<https://repositorij.unios.hr/islandora/object/pfos%3A1602/datastream/PDF/view>
- Falan, V., Mujcinovic, A. (2022). Troškovi i kalkulacije u agroindustriji, Poljoprivredni Fakultet Univerziteta u Sarajevu, Sarajevo, BiH.
- Falla, N.M., Caser, M., Demasi, S., & Scariot, V. (2022). Heat Pump Drying of Lavender Flowers Leads to Decoctions Richer in Bioactive Compounds. *Agronomy*. <https://doi.org/10.3390/agronomy12123162>
- Gadžo, D., Đikić, M., Jovović, Z., Mijić, A. (2017). Alternativni ratarski usjevi. https://www.researchgate.net/profile/Drena-Gadzo/publication/329443025_ALTERNATIVNI_RATARSKI_USJEVI/links/5c08cf8aa6fdcc494fdb4b8/ALTERNATIVNI-RATARSKI-USJEVI.pdf
- Grbesa, A. (2016). Morfološka obilježja i ljekoviota svojskva lavande, te mogućnosti njena uzgoja, Doktorska disertacija, Josip Juraj Strossmayer University of Osijek. Faculty of agriculture.
<https://zir.nsk.hr/islandora/object/pfos%3A865/datastream/PDF/view>
- Jurkic, D. (2014). Ekonomska učinkovitost proizvodnje lavande, Doktorska disertacija, Josip Juraj Strossmayer University of Osijek. Faculty of agriculture.
<https://zir.nsk.hr/islandora/object/pfos%3A619/datastream/PDF/view>
- Łyczko, J., Jałoszyński, K., Surma, M., García-Garví, J.M., & Szumny, A. (2019). Determination of Various Drying Methods' Impact on Odour Quality of True Lavender (*Lavandula angustifolia* Mill.) Flowers. *Molecules*. <https://doi.org/10.3390/molecules24162900>
- Masztalerz, K., Łyczko, J., & Lech, K. (2021). Effect of Filtrated Osmotic Solution Based on Concentrated Chokeberry Juice and Mint Extract on the Drying Kinetics, Energy Consumption and Physicochemical Properties of Dried Apples. *Molecules*. <https://doi.org/10.3390/molecules26113274>
- Mihovilovic, I. (2005). Proizvodnja i prerada ljekovitog i aromatičnog bilja. Grad Senj, Razvojna agencija Senj doo, Hrvatski zavod za zapošljavanje, Senj, 30.
https://www.ras.hr/Media/Ljekovito_bilje.pdf
- Mulic, J. (1983). Troškovi i kalkulacije u OUR agroindustrijskog sistema, Poljoprivredni Fakultet Univerziteta u Sarajevu, Sarajevo, BiH.
- Parida, S., & Sharma, D. (2022). Chapter-5 Lavender: A Great Source of Essential Oil. *AND ITS BENEFITS*, 85.
https://www.researchgate.net/profile/Muhammad-Akram-88/publication/359842849_A_Comprehensive_Review_on_the_Pharmacologi

- cal_Potential_of_Butea_monosperma_Lam/links/62513e8cb0cee02d695cd289/A-Comprehensive-Review-on-the-Pharmacological-Potential-of-Butea-monosperma-Lam.pdf#page=93
- Sařata, A. (2020). The Supplementary Irrigation and Drying Method Affect the Yield and Essential Oil Content and Composition of Lavender (*Lavandula angustifolia* Mill.) Flowers. Acta Scientiarum Polonorum Hortorum Cultus. <https://doi.org/10.24326/asphc.2020.6.12>
- Siljes I., Grozdanić, Dj., Grgesina, I. (1992). Poznavanje, uzgoj i prerada ljekovitog bilja, Školska knjiga, Zagreb https://prirodnamedicina.org/knjige/Siljes_Grozdanic_Grgesina--Uzgoj_i_prerada_ljekovitog_bilja.pdf
- Singh, S., Singh, V., Babu, G.K., Kaul, V.K., & Ahuja, P.S. (2007). Economics of lavender (*LAVANDULA OFFICINALIS* L.). Journal of Non-Timber Forest Products, 14(2), 97-100. [file:///C:/Users/Sejla/Downloads/LavenderEconomics%20\(3\).pdf](file:///C:/Users/Sejla/Downloads/LavenderEconomics%20(3).pdf)
- Zutic, I. (2014). Lavandin, kadulja i komorač u kontinentalnom području. <https://repositorij.unizg.hr/islandora/object/agr%3A1216/datastream/FILE0/view>

CIJENA KOŠTANJA UZGOJA LAVANDE (*LAVANDULA OFFICINALIS*) I EKONOMSKA UČINKOVITOST NJEZINE PRERADE NA PODRUČJU FEDERACIJE BOSNE I HERCEGOVINE

Abstract

Lavanda je jedna od najpoznatijih ukrasnih, aromatičnih i ljekovitih biljaka porodice Lamiaceae. Široko se koristi u kozmetičkoj, farmaceutskoj i prehrambenoj industriji i odlična je medonosna biljka. Plantažni uzgoj lavande u BiH još uvijek nije toliko razvijen kao u drugim zemljama. Ipak, sve veći broj farmi i specijaliziranih farmi prepoznaje potencijal ove kulture. S obzirom na potrebu za dodatnim istraživanjima ekonomskih rezultata uzgoja lavande u Bosni i Hercegovini, ovo istraživanje ima za cilj analizirati cijenu uzgoja svježe lavande i ekonomsku efikasnost njene prerade. Primarni podaci prikupljeni su uz pomoć anketa provedenih na četiri farme, s fokusom na potrebna ulaganja i operativne troškove uzgoja lavande i prihode od prodaje sušenog cvijeća. Rezultati su pokazali da se cijena uzgoja 1 kg svježeg cvijeća lavande kreće od

0,71 KM do 1,33 KM, što ukazuje na značajne razlike između posmatranih farmi. Prerada lavande je takođe pokazala različite nivoe ekonomičnosti među farmama. Prema ovom istraživanju, uzgoj lavande u Bosni i Hercegovini je ekonomski isplativa opcija; međutim, potrebno je istražiti veći broj farmi. Također, zbog različitih primijenjenih poljoprivrednih tehnika u uzgoju lavande, ekonomski rezultati se značajno razlikuju od farme do farme, pa je jedna od preporuka istraživanja dodatna edukacija proizvođača u ovoj oblasti za povećanje ekonomske efikasnosti ovih farmi uz unapređenje proizvode tehnologije.

Keywords: *economic efficiency, cost price, lavender, Federation of Bosnia and Herzegovina*